

## EXHIBIT 3

# Phase Tracking and Prediction

Timothy Sherwood, Suleyman Sair and Brad Calder  
CS2002-0710  
June 23, 2002

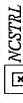
In a single second a modern processor can execute billions of instructions. Obtaining a bird's eye view of the behavior of a program at these speeds can be a difficult task when all that is available is cycle by cycle examination. In many programs, behavior is anything but steady state, and understanding the patterns of behavior at run-time can unlock a multitude of optimization opportunities. In this paper we present a unified profiling architecture that can efficiently capture, classify, and predict program behavior on the largest of time scales all at run-time with no support from software. By examining the proportion of instructions that were executed from different sections of code, we can find generic phases that correspond to changes in behavior across many metrics. By classifying phases generically, we avoid the need to identify phases for each optimization, and enable a unified prediction scheme that can forecast future behavior. We examine the ability of our phase tracking architecture to accurately capture the phase behavior of a program's execution with respect to its overall performance (IPC), branch prediction, cache performance, and energy, and show how phase behavior may be captured efficiently using a simple predictor.

## How to view this document

- Display the whole document in one of the following formats.
  - [PostScript](#) 10012 bytes.
- [Print or download all or selected pages.](#)

The authors of these documents have submitted their reports to this technical report series for the purpose of non-commercial dissemination of scientific work. The reports are copyrighted by the authors, and their existence in electronic format does not imply that the authors have relinquished any rights. You may copy a report for scholarly, non-commercial purposes, such as research or instruction, provided that you agree to respect the author's copyright. For information concerning the use of this document for other than research or instructional purposes, contact the authors. Other information concerning this technical report series can be obtained from the Computer Science and Engineering Department at the University of California at San Diego, [techreports@cs.ucsd.edu](mailto:techreports@cs.ucsd.edu).

[ Search ]



*This server operates at UCSD Computer Science and Engineering.  
Send email to [webmaster@cs.ucsd.edu](mailto:webmaster@cs.ucsd.edu)*